

5440-13 Science

The holder is authorized to teach science in grades 7-12.

In order to qualify for this endorsement, the candidate shall demonstrate the following:

Knowledge Standards:

Demonstrates knowledge of scientific content, concepts, and skills delineated in current national professional standards¹ and in *Vermont's Framework of Standards and Learning Opportunities* including:

Scientific method; investigatory processes and procedures; the nature of theory; roles and responsibilities of scientists; history of science

Typical scientific misconceptions or naïve ideas held by early to late adolescents

Life Sciences – Cell structure and function; anatomy and physiology; molecular basis of heredity; biological evolution; interdependence of organisms; matter, energy and organization in living systems; behavior of organisms

Physical Sciences – The structure of atoms; structure and properties of matter; chemical reactions; motion and forces; conservation of energy and increase in disorder; interactions of energy and matter

Earth, Environmental, and Atmospheric Sciences – The Earth as an integrated system of chemical, physical and biological processes interconnecting the geosphere, hydrosphere, atmosphere, and biosphere; the origins and evolution of the Earth, solar system, and universe, and forces effecting and shaping them over time

Living and Non-Living Systems – The concept of living and non-living systems as collections of interrelated parts and interconnected systems; continuity and change in living and non-living systems from the micro to the macro scale; how personal and collective actions can affect the sustainability of interrelated systems

Performance Standards:

Implements a science curriculum that integrates scientific inquiry skills and scientific content, and enables conceptual development and development of the habits of mind that support scientific inquiry. Specifically, the educator:

Anticipates and elicits the naïve scientific ideas, emerging concepts, and/or misconceptions that students are likely to have prior to instruction

Models the skills, attitudes, and values of scientific inquiry

Asks scientific questions that engage students and helps them to formulate meaningful scientific questions of their own

5440-13 Science (Cont'd)

Designs and implements investigations and assessments that engage students in experimental design, data collection, data analysis, and problem solving, and that provide them with frequent interactions with the natural world as a regular part of the science program

Teaches students how to create strategies to solve scientific problems of increasing complexity by engaging in metacognitive analysis of their own scientific thinking

Creates opportunities for students to collaboratively design and implement scientific investigations, and to present and discuss the results of their investigations

Organizes equipment, work, and learning spaces so that scientific investigations are carried out safely in accordance with state and national safety guidelines

Teaches forms of scientific communication including how to write clear, well-organized science reports; how to read sources of scientific information; and how to understand and use representation and scientific notation

Integrates physical, mathematical, scientific, and technological tools appropriate to students' ages and abilities in order to facilitate scientific inquiry

Conveys to students how the development of scientific theory and understanding is a historical process with continuous creation of new knowledge and refinement or rejection of “old” knowledge

Conveys to students the roles and responsibilities of scientists with respect to social, economic, cultural and political systems, and provides them with opportunities to actively explore the full scope of career choices available to people in the sciences

Demonstrates sensitivity to inequities in science teaching and careers by incorporating specific instructional strategies that promote equity

Additional Requirements:

A major in biology, chemistry, physics, or earth/environmental/atmospheric sciences, or the equivalent in undergraduate and/or graduate coursework.

A minimum of a practicum, or the equivalent, at the middle/secondary level (7-12) in science, social studies, math, or English.

¹ e.g. *National Science Education Standards* (1996, National Academy of Sciences), *Benchmarks for Science Literacy* (1993, Oxford University Press)